Sagebrush Steppe
SageSTEP
Treatment Evaluation Project

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Evolution of the SageSTEP Research Project: The next step

By Lael Gilbert, SageSTEP Outreach Coordinator

One challenge of a long-term evaluation project is simply the fact that it is long-term. While desert ecosystems operate over the slow arc of decades, the people who study and monitor them move at a faster clip. We've recently had the opportunity to welcome some new faces to the SageSTEP research team, and to send best wishes to some of our scientists moving into retirement. We salute those who have dedicated their time, energy, and careers to this work, and we'd like to welcome the ideas and perspective of the incoming scientists who have taken up the baton.

Into the Sunset

SageSTEP Scientists who are moving into retirement

Steve Bunting, Rangeland Ecologist, focused on understanding the function of disturbance, particularly fire, in the dynamics of rangeland ecosystems. In retirement, Bunting plans on traveling more, doing more fishing, and trying to keep his fleet of 50-year-old vehicles running so that he can travel and fish.

Dale Johnson, Soil Scientist, researched soils and biogeochemical cycling including the influence of atmospheric pollution, climate change, and fire. He retired three years ago and has been actively relaxing in the Reno area. He and his significant other, Barb, vacation in a Casita trailer, and visit family here and abroad. Johnson still works on the Kings River Experimental Watershed project as a consultant helping Carolyn Hunsaker crunch large data sets and prepare publications.

Mike Pellant, Rangeland Ecologist. As Coordinator of the Great Basin Restoration Initiative, Pellant worked to develop and implement partnership-based management strategies to restore areas of high values, reduce the effects of annual grasses and noxious weeds in others, and reverse the destructive cycle of wildland fires and weeds. When fully retired at the end of this year, he plans on doing some consulting, enjoying granddaughters and spending more time at his cabin near McCall, ID.

Paul Doescher, Plant Ecologist. His work focused on restoration of shrub steppe and woodland communities in the Intermountain West, fire ecology, and ecological and physiological dynamics of plant species. He will retire in July and plans to do some traveling with his wife, Sue – see fall colors in the Northeast and the next big desert bloom in the southwest – and also to catch up on some fly fishing.

Bruce Shindler, Social Scientist, focused on social responses to ecosystem management practices, public acceptance of wildland fire management and fuel reduction practices, and public agency-community interactions. He'll be retiring this summer and admits that he has no concept of what retirement means. He says that he'll be taking it day by day with the hope finding some interesting projects to connect with.

Rick Miller, Rangeland Ecologist. He studied spatial and temporal dynamics of sagebrush and juniper woodlands in the Intermountain Region with an emphasis in fire. He considers himself part-time retired, and continues to work for Great Basin Fire Science Exchange, to complete a synthesis on the state of knowledge on fire in the Great Basin. He is currently working on a book on the ecology, history, and management of pinyon juniper woodlands in the Great Basin and Colorado Plateau. When not working, he and his wife travel to Europe, the Galapagos, and the Amazon, fly fish at the southern tip of Chile for sea-run brown trout, and spend time with family.

Robin J. Tausch is an Emeritus Range Scientist Volunteer with the Forest Service, Reno Laboratory, Rocky Mountain Research Station. Since retiring three-and-a-half years ago he has continued research efforts applying concepts from the fields of paleoecology, macro-ecology, and the metabolic theory of ecology to the study of Great Basin communities. These concepts are being applied to develop

models describing vegetation community competitive dynamics over time. Results can provide information for understanding how Great Basin communities will change over the rest of the century in response to both ongoing climate change and the presence of exotic plant species.

A Warm Welcome

Featuring Incoming SageSTEP Scientists and Staff

Ben Rau, Research Ecologist. Rau's work encompasses disturbance and management in native and agro-ecosystems with an emphasis on plant-soil interactions and biogeochemistry. His work with SageSTEP is focused on invasive species and fuel reduction influence on carbon and nitrogen cycling. Ben has also taken the lead in developing a carbon budget for BLM lands in the Great Basin, using SageSTEP data as the core. Rau is a research ecologist with the USDA Forest Service, Southern Research Station.

April Hulet, Rangeland Ecologist. Research interests include conservation and restoration ecology, applied rangeland ecology and management, disturbance ecology, fire ecology, remote sensing and GIS. Hulet has been active in acquiring funding for her research using in part SageSTEP data. She is an assistant professor in the department of Forest, Rangeland, and Fire Sciences at the University of Idaho but has been engaged with other SageSTEP PIs consistently over the years on various projects including work with Eva Strand on fuel bed analysis.

Eva Strand, Rangeland Ecologist. Research interests include geospatial analysis, remote sensing, landscape and spatial ecology, rangeland ecology, and fire science. She has also helped us better understand the fuel-bed consequences of the shredding treatment used in woodland-encroached sagebrush steppe, including both how fuel loading and potential fire behavior are affected. Strand will soon bring on a student to assist her in developing the 10-year post-treatment photo fuels guide. Strand is an assistant professor in the department of Forest, Rangeland, and Fire Sciences at the University of Idaho.

Zach Aanderud, Microbial and Ecosystem Ecologist. Much of Aanderud's research links temporal fluctuations in resources to microbial community structure and ecosystem services. This overarching theme has inspired questions relating to the: 1) consequences of rainfall and snowfall change on bacterial community assembly and trace gas production; 2) impacts of disturbances and plant-soil-microbial interactions on C and N cycling in cold desert ecosystems; and 3) more recently, roles of bacterial functional traits in surviving and thriving in extreme environments. Zach has also been involved with a group of us (with Jim Grace), in an attempt to construct and test a multivariate model that illustrates the key factors behind vegetation response to SageSTEP treatments. Aanderud is an associate professor in Plant & Wildlife Sciences at Brigham Young University, and enjoys backpacking, skiing, coaching competitive soccer, and goofing off with his wife and four children.

Maggie Gray, Site Manager. Gray manages the day-to-day operations of the SageSTEP East network, including field and laboratory work. She is the eastern counterpart to Scott Shaff, who has managed the western sites for several years. Her principal duties include plot layout, coordinating and overseeing treatment application, fuels data collection, soil sampling, data management, and manuscript preparation. Do you have questions or concerns about an eastern SageSTEP site? Contact Maggie at 435-797-2569 or email her at this address: maggie.gray@usu.edu

Jason Williams, Research Hydrologist. Research interests include the ecohydrologic and erosional ramifications of plant community transitions, fire, and other disturbances and the ecohydrologic benefits of land management practices. Williams has been actively researching the hydrologic and erosional impacts of woodland encroachment and tree removal treatments with the SageSTEP study since 2006. His research, along with Dr. Fred Pierson (SageSTEP PI, USDA-ARS-Boise), has greatly advanced understanding of pinyon and juniper encroachment on hydrologic and erosion processes and the ecohydrologic impacts of tree removal by cutting, mastication, prescribed fire, and wildland fire. This research has also contributed to numerous synthesis publications on rangeland hydrology and erosion responses to disturbances and management and to the enhancement of the Rangeland Hydrology and Erosion Model for application to disturbed rangelands and development of Ecological Site Descriptions. Dr. Williams is currently a Research Hydrologist with the USDA Agricultural Research Service.

Other scientists who have joined the team include **Lisa Ellsworth**, **Beth Newingham**, **Keireth Snyder**, and **Steve Peterson**. We look forward to seeing them in action.

Other Valuable Contributions

There are many other people who have made valuable contributions to the work at SageSTEP over the years. These people, along with stellar graduate students and many members of hard-working field crews, have since moved on to other positions and challenges. We'd like to note a few of them as well.

Support and Consultation

Summer Olsen – Outreach Coordinator
Liz Didier – Outreach Coordinator
Lee Davis – Eastern Site Manager
Jeff Burnham – Eastern Site Manger
Brad Jessop – Juniper Pinyon Site Manager
Travis Miller – Pinyon Juniper Site Manager
Neil Frakes – Pinyon Juniper Site Manager
Jaime Ratchford – Western Juniper Site Manager
Patrick Kormos – Hydrology Field Crew Leader
Steve Hanser – Bird Field Crew Leader
Matthias Leu – Bird Field Crew Leader
Karen Erickson – Entomological Assistant
Euell Macke – Entomological Assistant
Courtney Loomis – Developed Data Store

Key Collaborating Scientists:

Nora Devoe – BLM Science Cord./ Management Liaison
Neil Rimbey – Collaborator on Economics
John Tanaka – Collaborator on Economics
Michael Taylor – Collaborator on Economics

Graduate Students:

Nathan Cline – M.S. on Hydrology and Soil Impacts
Corinne Duncan – M.S. on Seed Dynamics
Ryan Gordon – Ph.D. Public Perceptions of Management
Michael Landis – M.S. on Fire Suppression Costs
Anna Maher – M.S. on Ranch Economics
Kristin Pekas – Seed Pool Dynamics
Michael Reisner – Ph.D. on Ecological Stress
Dara Scherpenisse – M.S. Mycorrhyzae and Native Grasses
Andy Stebleton-Bourne – M.A. Thesis -- Fuel Guides
U.C. Wijayratne – Ph.D. on Sage Seed Longevity
Kert Young – Ph.D. on Fuels, Mastication Impacts

SageSTEP Counts Carbon: Augmenting Protocol

We've augmented monitoring protocol this year to gain better insight on carbon sequestration levels in the Great Basin. In response to a request from the Bureau of Land Management (BLM), additional carbon measurements will be used to answer three key questions: 1) What are current levels of above- and belowground carbon capital in salt desert shrub and sagebrush communities of the Great Basin?; 2) How have restoration treatments like those studied in SageSTEP altered these carbon levels in sagebrush steppe?; and 3) How have wildfires in the past ten years altered carbon levels across the Great Basin?

Estimates on carbon in response to these questions will improve our understanding of how land management and climate warming have influenced carbon levels recently, and how these levels might be expected to change in the next several decades. Ultimately, this information will allow us to compare the Great Basin with other better-understood ecotypes to determine whether this area is a carbon sink or a carbon source.

SageSTEP has already produced considerable information about carbon by way of established monitoring protocols. In particular, within both treeless and woodland-influenced sagebrush steppe, a repeat of the soil coring to bedrock that Dr. Benjamin Rau conducted in 2006-2009, along with aboveground vegetation measurements, will help determine how restoration treatments in sagebrush steppe have influenced carbon levels (question 2), and will also allow estimation of carbon sequestration levels in sagebrush steppe (question 1). Additional coring and vegetation work in greasewood, salt desert shrub, low sagebrush, and sites converted to annual grass, will allow us to estimate carbon levels in the principal lower elevation Great Basin ecotypes (lower than montane) managed by the BLM. Thus, field crews have been asked to take soil cores and apply SageSTEP monitoring protocols in ecotypes at lower elevation and adjacent to existing SageSTEP sites, in both the Lahontan and Bonneville regions of the Great Basin. This information, combined with information already collected from 2006-2009, will allow us to answer questions 1 and 2.

To understand how wildfires in the past 10 years have altered basin-wide carbon levels (question 3), Dr. Rau will work with Dr. Bethany Bradley (University of Massachusetts), and combine field measurements taken between 2006 and 2018, with remotely sensed information on cheatgrass extent. This will give us much better information on how much carbon we lose when woody vegetation is converted to grassland, and how much carbon we gain when we manage to hold onto native perennial bunchgrasses. Ultimately, we expect that this kind of information will confirm that conservation of the native perennial bunchgrasses is the key to land management in the Great Basin, not only for carbon, but for native birds, erosion and runoff, and overall fire risk as well.

New Point of View:

Using visual data to better understand treatment change

Since the start of work in 2006, part of the measurement protocol for SageSTEP sub-plots has called for taking two photos across each of the 30 x 33 m sub-plots, for two of the transects along which line-point vegetation measurements are taken. A complete set of photos was taken pre-treatment (2006) for each of the ~1200 SageSTEP sub-plots, and then repeated each year post-treatment from 2007 until the present. This has produced a total of ~15,000 photos, all of which have been sorted and classified by individual photo and sequence quality.

Visual data like these, covering many years of treatment response, are valuable for capturing a general impression of what has happened in our sub-plots over time, and their value will increase with time. Because these visual scenes represent measured sub-plots, we can augment our subjective interpretation of them with the use of quantitative data taken with our line-point protocol, each time we've visited the sub-plots. The combination of a repeat visual scene with a quantitative description of the vegetation, ground cover, and fuel mass it represents, offers powerful insight on treatment response, and also what has happened to the sub-plots over time in the absence of treatment.

For example, to the right and on the next page is a repeat photo sequence from the Greenville Bench site, representing what happened in one spot within the bullhog mastication plot after it was treated in 2007. Quantitative data were extracted directly from our on-line database, and are valuable for augmenting visual impressions of this sub-plot scene before treatment, and six years after treatment.

We plan to post all 1200 or so sub-plot photo sequences on our database soon, each linked to quantitative data they represent. A representative sample of these photo sequences, covering both untreated control and treated plots, will be posted on our website in the fall of 2016.

Repeat photos, like this series from the Greenville Bench bullhog treatment, can augment data interpretations. See next page for a narrative to accompany the series.

Greenville Bench Bullhog Photo Points

Sub-Plot 3, 30 m transect (Initial Phase II Woodland): This is a set of five photos taken in the same place in 2006, 2008, 2009, 2010, and 2013.

- Site: Greenville Bench
- Tree Species: Utah Juniper
- Treatment Plot: Bullhog Mastication
- Pre-Treatment Year: 2006
- Treatment Year: 2007
- Post-Treatment Years: 2008 - 2013
- Measurement Sub-Plot: 3
- Sub-Plot Photo Location: 30 meter transect

a. While the mastication treatment appeared to have killed most trees, the large size and nearly complete structure of the debris, in addition to the presence of small trees, indicates that mastication was imperfect.

b. Substantial amounts of down woody material were produced by mastication, with line-point data indicating a mass increase from 6136 kg/ha pre-treatment (2006) to 21834 kg/ha one year after treatment (2008), more than triple the original mass. By 2013, total woody fuel mass decreased to 15625 kg/ha, indicating significant decay, but the great majority of this decrease occurred in the 10-hr fuel category (< 2.54 cm diameter {< 1"}). Mass of the heaviest fuel (1000-hr) remained very high by 2013, indicating that very little decay had occurred in this size category (> 7.62 cm diameter {> 3"}).

c. No litter or moss cover appears in any of the photos, and this is confirmed by line-point data, which did not reveal any ground cover of litter or moss.

d. Cheatgrass appears to be absent throughout the time period 2006 to 2009, and line-point data confirms that annual grass cover was < 1% during this period. However, the photos show abundant cheatgrass in 2010 and 2013, indicated as the brownish grass between the perennial cover; line-point data confirms that cheatgrass increased to 10.7 and 18.7% in 2010 and 2013 respectively.

e. Native perennial grass cover increased steadily from 6.3% pre-treatment (2006) to 24% in 2013, corresponding to a parallel decrease in mean basal gap size, which decreased from 2.54 m pre-treatment to 1.12 m in 2013. Clearly, treatment stimulated the growth of bunchgrass individuals, and this was the main factor behind decreased mean gap size -- compare the amount of bare ground between perennial grasses and forbs in the pre-treatment 2006 photo versus the 2013 photo..

f. Forbs did not appear to respond to treatment, with cover remaining low throughout the time period, at < 2% cover for all years except 2010 (7%).

g. A few shrub individuals are visible in the 2006 pre-treatment photo, but they appear to be stunted. Some shrub growth (primarily rabbitbrush) seems evident by the six-year mark (2013), but shrub cover increased only slightly over the seven-year time period, from 4% in 2006 to just 5% in 2013.

h. Overall, the bullhog mastication treatment removed most trees, but left some smaller trees and relatively large woody debris on site. Mastication treatment generated a substantial mass of down woody material, more than triple the original pre-treatment amount. After six years, nearly 30% of this material had decayed, but almost all decay occurred in the smallest size class of fuel (10-hr; < 2.54 cm diameter). The treatment stimulated substantial grass growth throughout the six-year post-time sequence, with total grass cover increasing from 7.3% pre-treatment (2006) to 43% six years after treatment (2013). While most of the total grass cover was native perennial, cheatgrass cover represented 40% of the total by 2013. Neither forbs nor shrubs appeared to have responded to treatment, with cover remaining at < 10% throughout the seven-year sequence.

By Jim McIver, 28 June 2016

We have been funded by:

To subscribe contact:
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www.sagestep.org

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- National Interagency Fire Center
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- USDA Forest Service
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